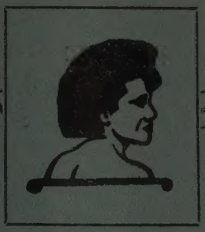
VOL. 18 NO. 1 MARCH, 1947



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AGRICULTURAL JOURNAL

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GOVERNMENT PRESS, SUVA, FIJI

Notes for Libraries and Research Institutes.

FORMER ISSUES OF AGRICULTURAL JOURNAL.

So many requests are received from abroad for parts of the *Agricultural Journal* which were never published that the following list of all issues published and those which are not now available is given for reference. Attention is especially directed to Volume 7 which had only one part:—

Vol.				*Vol.*			
1.	3	numbers,	1928.	10.	4	numbers,	1939 (none of Nos. 2 and 4).
2.	4	,,	1929.	11.	4	,,	1940 (none).
3.	3	,,	1930 (none).	12.	4	,,	1941 (none of Nos. 1 and 2).
4.	4	,,	1931.	13.	4	,,	1942.
5.	2	,,	1932 (none of No. 2).	14.	4	,,	1943.
6.	2	,,	1933.	15.	4	,,	1944.
7.	1	,,	1934.	16.	4	,,	1945.
8.	4	,,	1935–37 (none of No. 4).	17.	4	,,	1946 (none of No. 1).
9.	4	,,	1938 (none of Nos. 2, 3 and 4).				

ISSUES OF THE AGRICULTURAL CIRCULAR.

NUMBERS and year of issue of the *Agricultural Circular* :—

Vol.	1,	1920,	12 numbers.	Vol.	4,	1923,	1 number.
	2,	1921,	5 ,,		5,	1924–5,	2 numbers.
	3,	1922,	4 ,,				

As number 4 of Vol. 3 was printed as " Volume 4 " and number 1 of Vol. 4 as " Volume 5 " it would appear from an inspection of a complete set that Volume 4 comprised only a number 4 and that there were two issues of Volume 5, No. 1.

ANNUAL BULLETINS.

THE Annual Bulletin of Divisional Reports ran from 1931 to 1938 and was then discontinued.

OLD ISSUES OF AGRICULTURAL BULLETINS.

FREE copies of the following Bulletins are available to Colonial Departments of Agriculture, research institutes and bona fide planters within the Colony.

No. 1. Sisal Hemp in Fiji, 1911.
3. Rhinoceros Beetle in Samoa, 1912.
4. The Banana in Fiji, 1912.
5. Scale Insect on Bananas, 1913.
6. Lemon Grass, 1913.
7. A Mission to Java for a Coleopterous Pest of Bananas, 1914.
8. Coconut Experiments, 1915.
9. Soils of Fiji—I, 1916.
11. Alluvial Soils of Fiji, 1919.
12. Leaf Moth of Coconuts, 1919.
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14. Transparent Coconut Scale, 1921.
15. Purple Leaf Moth of Coconuts, 1924.
18. Control of Coconut Spike Moth, 1935.

The following are available to the public at the prices shown—

No. 21. Biological Control of the Rhinoceros Beetle, 1941. Price 1s.
21A. Fijian Plant Names, 1942. Price 3s. 6d., 4s. and 6s.
22. An introduction to the Mosquitoes of Fiji, 1943. Price 1s.
23. Insect Pests in Fiji, 1946. Price 1s.
Gardening Notes, Insect Pest Control and Plant Diseases, 1945. Price 1s.

Applications should be made to the Librarian, Department of Agriculture, Suva, Fiji.

—EDITOR.

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AGRICULTURAL JOURNAL

ISSUED BY THE

DEPARTMENT OF AGRICULTURE, FIJI

VOL. 18 MARCH, 1947. NO. 1

EDITORIAL

Readers will note in the present issue changes in the form of the *Journal* which have been made possible by the interest and continuing advice of the Government Printer (Mr. F. W. Smith). It is hoped in due course to provide for illustrations and for other improvements so as to develop a periodical of increasing interest and practical value to the whole farming public of the Colony. It is timely therefore to review briefly the history of Departmental publications during the past forty years.

Since 1911 the publications of the Department of Agriculture, Fiji, have provided an information service for planters, farmers, gardeners and others concerned in agricultural pursuits. At an early stage numerous pamphlets were issued and between 1911 and 1920 thirteen important bulletins were issued dealing with soils, crops, insect pests and coconut experiments.

In 1920 the *Agricultural Circular* was instituted, the aim being to publish a monthly bulletin of current information of practical interest to land-holders in the Colony. An introductory note contributed by His Excellency the Governor referred to the scope of the publication which, he suggested, should not be confined to subjects of agricultural and pastoral interest and should not be entirely technical. He invited contributions describing methods, raising questions for discussion, suggesting new ideas and setting forth difficulties and experiences in connexion with stock-raising and planting—and expressed a hope that the publication "would be a means of furthering that which—whether between individuals engaged in the same industry, or between different industries or between the Colonists and the Government—is essential to the progress of the community as a whole, namely *co-operation.*"

During a life of five years, twenty-four numbers were issued. These contained authoritative and valuable contributions by Knowles and d'Espessis on crops, by Wakefield Rainey on the livestock of the Colony, by Simmonds on crop pests and by Wright on soils and agricultural chemistry.

Although the Circular met with a favourable reception among the planters of the Colony it was discontinued in 1926 pending a decision on the question of the formation of a semi-official agricultural society that would have issued a quarterly as its official organ. When in 1927 it was decided not to proceed with the formation of a society, an amount was placed on the Estimates for 1928 to enable a quarterly to be issued by the Department. In introducing the first number of Volume 1 of the new *Agricultural Journal*, the Editor ventured to express the hope that the new publication would be "as favourably received among the planting community as was the Circular."

During the ensuing nineteen years the *Journal* has been produced with increasing regularity and with greater attention to the need for original contributions from officers serving in the Colony. Altogether during that period, seventeen volumes comprising 60 numbers have been issued and the total circulation has grown to 650. At the same time nine special bulletins have also been published and one handbook on gardening with notes on pest and disease control of garden crops.

The present distribution of the *Journal* is as follows—

Planters and farmers in the Colony	74
Official institutions and individuals (local)	165
General public (local)	120
Overseas (official exchanges) ..	291
	650

The demand from overseas for the *Journal* has grown steadily and, in exchange, the Department receives many valuable publications from agricultural research stations and institutions throughout the world.

In view of the objects of the *Agricultural Journal* its distribution within the Colony is of great importance and it has long been felt that this should be encouraged by including more popular and less technical articles and by issuing supplements in the Fijian and Hindustani languages. The publication of supplements in these languages was, in fact, approved some two years ago but pressure of work in the Government Printing Office and difficulty in arranging for the regular translation of articles has limited our efforts to the supply of material to the vernacular press. Past Editors have always welcomed suggestions for the improvement of the *Journal* and the present Editor again invites the co-operation of readers, particularly those engaged in the oldest and most important of human industries, in bringing to notice and record the fruits of their knowledge and experience of local agriculture.

SOILS OF FIJI

By W. J. BLACKIE, M.Sc., F.I.C., F.N.Z.I.C.

In 1945 a Soils Sub-Committee of the Colonial Advisory Council was established for the purpose of studying the available information on Colonial soil types. The following notes are a summary of the information provided as a basis for the classification of local soils.

The topography of Fiji is mountainous, chains divide the main islands to give wet and dry zones. In wet zone rainfall about 140 in., in dry, 70 in. (Nov.–Mar.). Mean average temperature 82°F (Maximum 94° and minimum 60°F in summer and winter). Humidity high in summer in wet zone.

Geology: Andesite, basalts, agglomerates, tuffs, marls, mudstones, granite, limestone, marble. Covering of tuffs and marls extensive.

Vegetation.—Rainforest in wet region of sub-tropical type. In part tall grass with isolated trees and bushes (former forest).

Soils—Zonal.——Pacific Islands——Red Earths—

(*a*) Red loams Red and Brown Earths of continuous rainfall belt;

(*b*) Red and Brown Earths on Lateritic soils of interrupted rainfall belt.

Intrazonal.—1. Alluvial and Colluvial soils including Coastal Plain soils and soils with impeded drainage.

2. Mountain soils.

Zonal Soils.—Those formed *in situ* belong to red earth groups and in all probability are closely related to U.S.D.A. Red earths of Pacific Islands. (*Cf.* Hawaii and Samoa) . . . Laterization is not intense—typical laterites are not encountered—(on marls, mudstones, volcanic ash and tuffs: same on agglomerate and on basalt at 2,500 ft.) Si/Al 1·6–1·8. Dominant feature of soils is extreme youthfulness, especially in dry zone where profiles are shallow to medium. Erosion is not extensive under shifting agriculture, but is so after bush fires in tall grass country of dry zone.

(*a*) Red loams are developed under tall bush, become browner at higher elevations and redder on basalts and occur on most rocks. Profile development is not pronounced even in deep soils and no concretionary material occurs under forest; pH 4·5–5·2 in surface to 6·2 at depth. Heavy soils are fairly saturated; total P_2O_5 high, available low; Si/Al 1·6–1·8.

(*b*) Red and brown earths under tall grass on most rocks. Generally red brown becoming yellow with depth; pH 6–6·5; nutrients fair to moderately good.

Intrazonal.—Mountain soils—occur on slopes of steep hills and mountainous country outside rain forest belt. Shallow (1 or 2 in.), under grass, have peculiar nut-like structure in dry season. Brown to black and occur on variety of parent material.

BRIEF HISTORY OF CO-OPERATION IN FIJI

BY B. E. V. PARHAM, M.A.

The following notes provide a brief historical record of official action (in connexion with the subject) and actual development of co-operation in the Colony of Fiji.

ADMINISTRATIVE ACTION.

In March 1931, following a debate in the Legislative Council on credit facilities for agriculturalists, the Secretary for Indian Affairs submitted a report on " Co-operative Credit Systems." An alternative suggestion was recorded, viz. that the Colonial Sugar Refining Company Limited should co-operate with government in the establishment of a Cane Growers' Bank.

In July 1931 a Committee was appointed " to report on the question of establishing co-operative societies for the promotion of thrift and self-help among farmers and other persons of limited means." This committee comprised the Director of Agriculture (Chairman), the Secretary for Indian Affairs and the Inspector of Indian Schools.

On 15th December the Report of the Committee was submitted together with a summary of necessary legislative provisions, under the following headings—

Control and Legislation.

Rights and Liabilities of Members.

Rights and Liabilities of a Registered Society.

Inspection, Audit and Dissolution.

By-laws.

The Committee recommended that early steps should be taken to encourage movements among the small producers of the Colony which will develop into co-operative organizations and that legislation should be enacted simultaneously. Great importance was attached to the post of Registrar.

In February 1932 Executive Council advised (1) that the report be submitted to the Secretary of State and (2) that no direct legislative action be taken; but that District Commissioners should encourage local co-operative societies established for purposes of mutual help in agricultural marketing and kindred purposes.

In November 1932 the Chairman of the Committee urged the appointment of a specially trained officer as Registrar and referred to the commencement in August 1931 of the Fijian Agricultural Schemes in Colo West and Nadroga and to the forward movement amongst certain sections of the agricultural community of the Colony.

The Secretary for Indian Affairs advised against the proposals on the grounds of (*a*) expense and (*b*) the individualistic outlook of Indians in Fiji; and no further action was taken for several years.

In 1937, following questions asked in Legislative Council concerning the establishment of a Land Bank or some form of co-operative credit, a Committee was appointed " to investigate a scheme for an agricultural bank and/or co-operative credit societies." The findings of this Committee were that the time was not then ripe for the inauguration of an agricultural bank nor for the creation of co-operative credit societies; but that the question should be reconsidered from time to time.

In March 1939 the Director of Agriculture proposed to form not more than three small co-operative Thrift and Credit Societies in selected areas in order to provide a practical means of observing the reactions of the Fijians to such principles. He submitted a schedule of " Model By-laws of Co-operative Thrift and Credit Societies."

Following legal advice, approval was granted (August 1939) for officers of the Department to advise and assist the members of any existing native " clubs " for a period of 12 months. Owing to conditions arising out of the war this advisory work continued for the next six years.

In August 1944 His Excellency, Sir P. Mitchell, prepared "A Memorandum on the Organization of Marketing by Small-scale Producers "[1]. The subject came up again for consideration early in 1945 when consideration was given to the action which should be taken to deal with the proposals to establish Co-operative Credit Societies and/or Agricultural Banks: but it was not

until April 1946 that a Committee was appointed with the following terms of reference: "To advise, after studying similar legislation in other Colonies, what provision should be included in a Bill dealing with the establishment of Co-operative Societies in Fiji."

The Committee studied available records of legislation in other Colonies, the Articles of Association of Societies already established in the Colony and the Model Ordinance provided during the year by the Right Honourable Secretary of State (2). Special consideration was given to local conditions and customs which might influence the successful operation of credit, marketing or consumers' retail societies in Fiji. The report of the Committee was submitted on 13th November, 1946, with a note regarding the importance to be attached to the appointment of a Registrar.

DEVELOPMENT OF CO-OPERATION IN FIJI.

(*a*) *European Co-operation.*

The only European Co-operative is the Rewa Co-operative Dairy Company Limited registered under the Companies Ordinance with a capital of £10,000 (£1 shares).

This Association of dairy farmers was established on 6th July, 1923, with an original membership of 23 with the object of manufacturing butter and ghee co-operatively. The present membership is 47 and the business is well established and operating efficiently.

(*b*) *Fijian Co-operation.*

Prior to 1939 there were in existence numerous Fijian clubs and associations formed by progressive elements for the prosecution of various agricultural and other activities on a simple co-operative basis. Amongst these may be mentioned the following:—

Agricultural clubs in the Western District at Bemana and Qalimare on the Sigatoka river, engaged in co-operative farming and marketing; a farmers' co-operative credit society at the Agricultural Settlement at Dobuilevu, Ra, and the Nausori Co-operative Marketing Association founded in 1938. Further reference to the development of these groups is given below.

During the war period several more Fijian marketing associations were formed as, for example, the Waibula Marketing Association, Tailevu, the Nayavu Club, the Nailega Club; and at Daku, there was organized a village co-operative unit engaged principally in the supply of mangrove firewood to military forces and to essential industries with a co-operative scheme for house building and village improvement.

At the present time there are a number of other Fijian groups engaged in co-operative activities with the object of earning profits.

With the exception of the Nausori Co-operative Marketing Association, none of these groups are registered or in any way protected by legislation.

(i) *Agricultural Clubs.*—In March 1938 almost all Fijians concerned in commercial agriculture in Qalimare (Nadroga) met and formed themselves into a district agricultural association with the aim of developing a district co-operative society.

In 1941, clubs were formed in the Mogodro (33 members) and Waicoka Districts while the Qalimare and Nokonoko Clubs were actively engaged in the cultivation of potatoes. Other cash crops grown by these clubs were yaqona, tobacco and maize. The funds of the clubs were augmented by regular contributions with the aim of providing financial assistance to members and to purchase seeds, bags and implements for members. Generally, minutes of all meetings were kept and under Native Regulations the Government Savings Bank Books were deposited with the District Officers for safe custody and expenditure was usually subject to approval. The aim of these clubs was also to accumulate sufficient funds to cover necessary agricultural credit facilities. The Qalimari Club, for example, finished the year 1940 with a credit balance of £36, the expenditure having mainly been for the purchase of seed potatoes.

In other parts of the Colony (e.g. in Naitasiri and Tailevu, Viti Levu and in Korotasere, Cakaudrove in Vanua Levu) there were numerous small groups of Fijians organized for agricultural purposes

as for example the cultivation of cash crops, rice, yaqona, maize or the purchasing of working animals and implements, or for storekeeping, stockraising and dairying (ghee production).

As early as 1931 the village of Naila, Dravo District, had with the encouragement of the District Administration embarked on a co-operative scheme for the cultivation of sugar cane. The history of this group is of particular interest owing to the series of changes which took place from time to time both in regard to the status of individual members and to their activities. From the original group ownership of draft stock and implements grew up individual ownership; and from initial attempts at communal control of cultivation and cropping developed individual farming. Later, these individuals were to recognize the value of co-operative effort particularly in the matter of marketing, and became and still are the nucleus of a larger co-operative association. Probably in no other place has more useful and progressive work been done and nowhere else has the sense of responsibility for and pride of ownership in the land been so developed.

(ii) *The "Viti Kabani" and the Fiji Planters' Association.*—Brief reference only need be made of these two organizations as both lacked the true principles of co-operation.

The former so called "Fiji Company" was founded by Apolosi Ranawai who for subversive acts was banished from the Colony. In this case under the guise of business run by Fijians for Fijians he merely collected subscriptions from so-called shareholders and converted them to his own use or to meet the expenses of his various quasi-religious and political schemes. His operations were in no sense based on co-operative principles and being illegal were promptly suppressed.

The Fiji Planters' Association was a genuine attempt by Fijians to conduct a marketing business on their own account. As a subsidiary of the "Viti Cauravou" (Young Fijian Society) it was properly constituted and registered as a company but was not as its name would suggest, an association of farmers or planters. Many Fijians subscribed voluntarily for shares but had little opportunity to contribute to the conduct of the Association's affairs; a circumstance which, owing to misdirected extravagance on the part of Directors, led to financial failure and liquidation. For a time the Association operated under a Banana exporter's licence; but was not directly concerned with the co-operative marketing of shareholders' produce; certain financial assistance from Government was made available in an effort to keep the Association on its feet, but this proved impossible. Shareholders were accepted from all over the Colony and were strangers to one another and to the business being conducted on their behalf.

(iii) *The Fijian Co-operative Market Association Limited.*—Special reference is necessary to this Association on account of its size and the extent of its activities.

The Association was founded in September 1938 when a meeting of Fijian farmers from 28 districts in the provinces of Naitasiri, Tailevu and Rewa resolved unanimously to co-operate in a scheme to establish a market booth at Nausori where their produce could be marketed on their behalf.

The Department of Agriculture was asked to support the scheme and in September 1939, largely as a result of the interest of the then District Commissioner Southern, the Nausori Town Board "approved in principle the proposal and agreed to consider plans and provide a site for the building."

The Association (then known as the Nausori Co-operative Marketing Association) elected a representative committee, obtained an advance of £185 from the Department of Agriculture, collected subscriptions from nearly 200 members and set about constructing the building at Nausori. This work was carried out by members, expenditure being limited to the actual cost of materials.

On 20th January, 1940, the building was opened by the Honourable H. C. Monckton, Adviser on Native Affairs; a supervisor was employed to record, grade and sell members' produce; and a clerical assistant was appointed.

Rules were drawn up at a General Meeting of members. These were based on the requirements laid down in the Industrial Associations Ordinance(3) and covered all operations of the Association and provided for the regulation of members and for the carrying on and, if necessary, the winding up of the Association's affairs. The management was placed in the hands of a committee of seven. Sales of produce were on an agreed commission basis. The whole of the advance for building material was refunded by October 1941.

War-time activities.—When at the outbreak of war the Department of Agriculture called upon the Association to undertake military supplies the committee had no difficulty in enlisting the full support of members and rapid development occurred as indicated in the following figures of produce supplied:—

Year.	*Fruit.*	*Vegetables.*	*Roots.*
	tons.	tons.	tons.
1940 (Nov./Dec.)	20	25	10
1941	82	110	145
1942	520	415	300
1943	900	460	1,200
1944	587	472	1,054

Brief mention may be made of other war-time activities which included the building on contract of 154 native type houses for military purposes, the supply of large quantities of bamboos, timber and other forest products required for defence purposes. In addition, groups of members were organized to work on urgent projects, e.g. aerodrome drainage and construction. Voluntary contributions were made from time to time to Red Cross and war appeal funds—approximately £250; to scholarship funds (Sukanaivalu Scholarship, £100; and recently £500 for the Gatton Agricultural Scholarship) and to other public objects. Credit facilities were available to members.

Formation of Company.—In November 1944 the Association was registered under the Companies Ordinance 1924 as a Public Company and has continued its work along co-operative principles. Among the Articles of Association are defined the following objects: "to offer facilities to farmers for the cultivation, processing, grading, marketing or shipment of their produce; to establish and maintain institutions for instructing and training members of the Fijian race; to raise the standard of living and education of the Fijian race; to improve the efficiency of agricultural production and to co-operate as far as possible with other races for the achievement of the above objects."

With the cessation of hostilities, increased attention has been given to export business and late in 1945 the Association was granted a Banana Exporter's Licence and allotted a suitable area. During 1946 the following produce was exported:—

Bananas.	3,370 cases
Pineapples	2,967 ,,
Mixed fruit	182 ,,
Vegetables	80 ,,
Peanuts	398 sacks
Tapioca starch ..	2 tons.

The Association has recently leased a site on the King's Road near Nasinu, on which to establish a banana packing shed and factory for the manufacture of tapioca starch and other products.

A tractor was purchased in 1944 and contract ploughing is carried out for members and others.

Details of the development and work of the Association have been published elsewhere and need not be stated fully here (4, 5, 6).

While this group has had, during the war period, close supervision and guidance from the Department of Agriculture, it has always been entirely responsible for its own affairs and for the past two years has carried on with a minimum of assistance.

(iii) *Other Fijian Co-operatives.*—Reference has been made to the numerous co-operative groups which are known to exist in all parts of the Colony. Information is available concerning only a few of these as follows:—

The Waibula Association was originally a marketing group which did excellent work during the war in supplying military forces. It now operates as an agricultural club growing bananas and runs a "yaqona" saloon.

The Dobuilevu Club, beginning as a Credit Society, developed during the war as a marketing organization, being well situated

to sustain army supplies for the Nadi areas. The members were all settlers on Crown land and with their abandonment of the settlement scheme, the Association was disbanded.

At Vaturu, Nadi, the Vaturu Planters' Association, registered apparently under the Industrial Associations Ordinance, comprises a number of Fijians who are interested in marketing their own native crops. They have moved their villages from the hills and established themselves in one large village near Nadi, where they are in a better position to market their crops.

There are groups elsewhere operating transport and ferry services, a bakery, fishing, village stores, eating houses and carrying out various agricultural activities. Information regarding their membership, constitution and financial arrangements is not available.

The necessity for advice and guidance is obvious, the need for legislation and the registration of these groups is emphasized by recent developments, e.g. at Daku where a very active and progressive group has met trouble owing to improper organization and lack of control. The idea of co-operation has a special appeal to Fijians as evidenced by the large number of attempts which have been made during the past fifteen years and by the progress made by those groups which have had advice at some period or other of their development.

(*c*) *Indian Co-operation.*

Among Indians the idea of co-operation has developed in a few places on a rather different basis. These were initiated during 1938, inaugural meetings of farmers being held at Lautoka, Nadi and Sigatoka. These were partly political in outlook and were more concerned with the prospects of organizing credit and co-operative store facilities for members. The principal group organized at this time was the Kisan (Sabhan) Sang or Farmers' Union. The membership was limited to lease- and freehold property holders only and the Union claimed no political associations. The objects were stated to be " to improve the condition of cultivators and to bring farmers together." A further aim was later recorded, viz. " to grow their own food in addition to sugar cane on Colonial Sugar Refining Company's land."

The Union which is registered under the Industrial Associations Ordinance(3) endeavoured to run co-operative stores; and appeared to be progressing on the right lines but as a result of a disagreement in the Board of Management, which resulted in legal action being taken, the Society has not functioned during the past two years. The Official Receiver was appointed to take charge of the stores which were established at Ba and Lautoka.

As a result of political dissension, this Society was split into two divisions as the Right and Left Wing of the Kisan Sangh. The latter supported the Maha Sangh, which is another registered Planters' Association not engaged in co-operative business but more interested in politics.

In September 1946, 300 members from six districts resigned from the Kisan Sangh and formed a new organization named Vishal Krishik Sangh (the General Farmers' Union).

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(1) 1944. Sir P. Mitchell—"Memorandum on Organization of Marketing by Small Scale Producers".
(2) 1946. Lucette, H.—Model Draft Ordinance for Co-operative Societies.
(3) 1945—Industrial Associations Ordinance—Laws of Fiji, Cap. 79, p. 807.
(4) 1940. Parham, B. E.—" Fijian Farmers' Co-operative Market at Nausori ", *Agric. Journ.* Fiji, Vol. 11, No. 1, p. 11.
(5) 1943. Harvey, C.—"A Further Note on the Nausori Co-operative Market "—ib. Vol. 14, No. 2, p. 36.
(6) 1944. *Fiji Times & Herald*—" Co-operative Marketing ", 12.7.44.

ROTATION OF PUMPKINS WITH PIGS

Few pig farmers realize the value of pumpkins as a fodder. At Nasinu a rotation of pigs with pumpkins and tapioca has been carried on for two years. During this time large crops of pumpkins have been grown on paddocks which have been used for 12 months previously as pig paddocks. The pumpkins when fed to pigs were eaten with relish and saved a considerable amount on the food bill.

This is one of the many instances where a rotation of crops and stock will be found to pay dividends. —H.T.B.H.

BRANDS AND BRANDING

By T. L. MUNE.

Many farmers are not aware of the requirements of the Brands Ordinance, and in particular the number of stock which can be kept without registering a brand is not clearly understood.

The Ordinance makes it clear in section four that no person shall keep more than four head of stock without the same being marked with the owner's registered brand. The stockowner who fails to comply with the provisions of this section renders himself liable to a fine of five pounds.

It must be stressed also that under the same section it is provided that any animal which has once been duly branded in accordance with this Ordinance shall not be liable to rebranding upon a change of ownership.

Some farmers are ignorant of the prescribed size of brand and position in which it must be applied. The Ordinance requires that the brand be of a specified size and placed in a specified position. Each letter, sign, or numeral of the brand must be not more than two and a half inches or less than two inches in length and not less than half an inch apart. In the Schedule (section 6 (1)) are set out the order and positions of brands. These are as follows:—

Position			
1	Embracing the near		shoulder
2	,,		ribs.
3	,,		thigh.
4	,,	off	shoulder
5	,,		ribs.
6	,,		thigh.
7	,,		neck.

Application for the registration of a brand must be made on a printed form obtainable from the Department of Agriculture in Suva, or in country districts from Veterinary Officers, Stock Inspectors and District Officers. With the application must be lodged the registration fee of 2s. 6d. A registered brand is valid for a period of five years from the date on which it is granted after which period it may be renewed. It is important that the renewal be made immediately or the brand may be cancelled.

Brands are best made as small as the law will allow, that is, with two-inch letters, signs or numerals, half an inch apart. The letters, signs or numerals should be heavy enough to hold heat and should taper towards the marking edge which should be from one-sixteenth to one-eighth of an inch thick. It is found that a small brand is more easily applied.

It is well to remember when branding that it is not a painless operation to the animal; therefore it should be done quickly and cleanly. To be sure of a clean brand two things are necessary. The branding iron must be hot and the animal must be held still. Do not use a branding iron half cold as it only burns the hair, or if applied two or three times in an effort to get a good burn of the skin, will cause a blotched brand. Both results are useless and unnecessarily cruel. The red hot iron should be held firmly by the handle with both hands, applied with reasonable pressure and held for as long as it takes to count three. Do not move the iron backwards and forwards as this causes blotched brands. Rub over the brand very gently with a little castor oil as this helps to ease the pain.

Where possible brand between the age of six and twelve months. At this age stock are easily thrown and held. Young horses can be thrown as for castrating. Before throwing a horse the brand position should be clipped to make sure of a clean brand.

An alternative method is acid branding. This method is usually favoured by dairy farmers and owners of fairly quiet cattle. Special brands made from bronze or copper, with very wide marking faces, are needed. Each sign or numeral has a concave face approximately half an inch in width.

How to Apply the Acid Brand.—Firstly, the hair on the site of the brand must be clipped as short as possible to enable the acid to come in direct contact with the skin. Secondly, pour a little acid into a flat dish, working it evenly over the surface. Then

dip the brand into the dish, taking care to put a thin layer of acid over the concave face only; if too much acid is taken up, wipe it off. Any acid which has managed to get on the sides of the numerals should be carefully wiped off. Too much acid is apt to run down the side of the animal and cause a large burn and a blotched brand.

Place the prepared branding iron squarely onto the clipped area, gently working the handle up and down to force the acid evenly over the skin.

Care should be taken not to use acid brands on wet skin or during wet weather, as under these conditions the acid will spread and ruin the brand.

PEANUT CULTIVATION

BY H. R. SURRIDGE, B.Sc., A.R.C.Sc. (I).

The Peanut(1) known also as the "ground nut" and "earth nut" is a small annual leguminous plant of a trailing habit, a native of Brazil and cultivated in most tropical countries. It is remarkable for its habit of burying its seed pods in the earth to ripen, hence its name "ground" or "earth" nut. In Fiji, however, "peanut" is the name generally used.

The cultivation and production of peanuts is an important industry in Africa, India, Burma, China, Java, America, West Indies and Australia.

New Zealand is a regular importer of peanuts, from 800 to 1,200 tons per annum being imported during the years 1936/39. Under present conditions (1947) New Zealand is prepared to issue licences to import peanuts from Fiji up to 50 per cent of the totals quoted above.

Peanuts are an important article of food, containing up to 45 per cent of oil, the best grades of which are used in the preparation of salad oils and margarine, while the poorer quality is used in the manufacture of toilet soaps. The residue or cake which is left over after the oil has been expressed from the nut is a valuable cattle food and where quality is poor, is used as a fertilizer.

SOILS.

Peanuts prefer a light friable, well limed and well tilled fertile soil. Such a soil ensures good crops which are easy to harvest and are clean and bright in colour. When grown in heavier soils they are more difficult to harvest and the shells poor in colour. Colour of shells is also affected by climate and it is found that the colour is better and brighter when grown in the drier zones of these islands, too much rain giving a darker and dirtier appearance to the shells when harvested. The peanut, being a legume, by its cultivation is beneficial to the soil having a fertilizing effect especially when the dead plant, after harvesting, is ploughed or dug into the soil. Because of this it is a valuable crop to use in the crop rotation and for improving the fertility of poorer soils. The soil should be thoroughly prepared by ploughing and harrowing before sowing commences.

SOWING.

About 40 lb of seed nuts are required to plant an acre, the crop taking four to five months to mature. The seed should be shelled before sowing, care being taken to use only sound nuts, any bruised or damaged nuts will quickly rot and so prove useless. Sow the seeds, two or three together, about 3 inches deep in rows from 24 inches to 30 inches apart, with about nine inches between the plants.

The best time for sowing is just at the onset of the rainy season, since the plant then has the most favourable conditions for growth and matures in time for harvesting to be undertaken at the onset of the dry season. Yields vary from 1,000–1,500 lb of seed in shell per acre, the shells representing about 25 per cent of the weight.

CULTIVATION.

Intensive cultivation is necessary and should be maintained as long as possible, a final loosening of the soil being made at flowering time. Since peanuts thrust their fruits downwards and into the soil for ripening, loose soil is required, hence the necessary cultivation to have the soil ready to receive the nuts as they grow and mature.

(1) *Arachis hypogaea.*

HARVESTING.

Usually the time to harvest is when the leaves of the plants commence to turn yellow when a few plants should be lifted and dried for a day in the sun. The shells and seed should be firm. Should, however, the weather be such as to maintain the leaves in a green condition after four to four and a half months growth, a few plants should be examined as indicated above and if the nuts are full, the crop should then be harvested.

In light and friable soils the plants may be pulled by hand and turned roots upward and left on the ground in the sun, to cure until the end of the day, when the nuts can be stripped off and dried carefully before being bagged.

When the soil is on the heavy side, the plants will need to be dug or ploughed up, when the same procedure may be adopted to cure them and then dry before bagging.

VARIETY.

The best variety for dessert is the large one known as " Virginia ", while the small varieties, which usually contain more oil and are therefore more suitable for the oil mill, are the " Indian " and " Spanish."

ROTATIONS.

Peanuts may be grown continuously in the same soil, but it is advisable and usually of greater benefit to plant them in a rotation, for example, they can be rotated with kumalas, tapioca, and many garden vegetables. When grown in the drier season, peanuts could follow a crop of dry land rice, to the advantage of both crops.

PESTS.

Rats and mice are two of the major pests of peanuts both at planting time and harvest time, as well as in store. Prevention at planting time may be effected by rolling the seeds in red lead before sowing, while when in store, they should be stored in rat proof bins.

The most serious disease in the field is that known as Crown rot or Peanut disease, the presence of which is denoted by the young plants wilting. The disease can be controlled by suitable treatment of the seed before sowing and intending growers are advised to contact officers of the Department of Agriculture as to the possibility of securing peanut seed which has been suitably treated, or of having their own seed treated so as to prevent this disease attacking their crop. Finally to secure the greatest advantage from such treatment every effort should be made to use only sound seed because any damaged or bruised seed will quickly affect other seed with which it comes into contact.

PERSONAL NOTES

DR. H. W. JACK:

Dr. Jack, Director of Agriculture, Fiji, from 1934 to 1945, who has since his retirement from the Colony been attached to the office of the Agricultural Adviser to the Secretary of State, has now been appointed Agricultural Adviser for South-East Asia with headquarters at Singapore.

Prior to his appointment to Fiji, Dr. Jack spent many years in the Malayan Department of Agriculture so that he is fully conversant with the agricultural conditions of the territories included in his present sphere of activity.

MR. H. M. STUCHBERY:

Mr. H. M. Stuchbery, formerly a Veternary Officer of the Department (1925–38) has recently been appointed Senior Veterinary Officer, Tanganyika Territory.

STAFF NOTES

Mr. C. Harvey, Director of Agriculture, returned to the Colony on 22nd March after spending vacation leave in the United Kingdom where he was able to attend to many matters connected with agricultural development. His activities included—attending a three-day conference of Colonial Directors of Agriculture at the Colonial Office; visiting small-holding estates of the Land Settlement Association at Carlisle (Cumberland) and Pan Drayton (Cambridge); visiting Jealott's Hill Experiment Station (Imperial Chemical Industries) *re* weed control; spending some time with Country Drainage Officer for Cornwall watching work in progress with mechanical drainage equipment under auspices of Country (War) Agricultural Committee and attending trade demonstrations of light agricultural equipment, e.g. light tractors, grass mowers, and rotary cultivators.

RINGWORM OF HORSES IN FIJI

BY H. T. B. HALL, B.V.Sc..

INTRODUCTION.

The disease of horses and cattle known as ringworm became serious in the Colony in 1944, and has remained prevalent during 1945 and 1946. Although no deaths directly attributable to the disease have occurred in livestock, serious interference with production has been caused particularly in the sugar-cane areas. The object of this report is to outline the history and present position regarding the disease.

HISTORY AND SPREAD OF THE DISEASE.

In the quarterly report of the Veterinary Officer Western, for the April–June quarter 1944, was the following report:—

"The only significant external parasite recorded during the quarter was ringworm. Though this parasite is normally more prevalent in horses and cattle during the months of May, June and July, this year the incidence is far greater and the degree of infection more severe. In the Western and Central Districts, particularly Lautoka and Nadi, about 60 per cent of all horses are affected and at least 25 per cent of cattle. Many horse cases have been so severe as to make them unfit for work. Owners have been advised to practise strict stable hygiene to prevent infection or re-infection. Treatment of some of the more valuable animals was attempted but though some improvement was noted, war-time shortage of drugs, the difficulty of getting labour to take sufficient care in the application of the mixtures provided and preventing re-infection, the results have been far from satisfactory."

The next report was received in December 1944 from the Stock Inspector, Ba, who stated that the disease was widespread in the Ba District.

In both the above cases it was assumed by the officer in the district that the climatic and nutritional condition at the time favoured the spread of the condition to a greater extent than the same season in previous years and it was not considered, until a few cases were found in the Suva District early in January 1945 that the present outbreak was more than the normal seasonal fluctuations usually observed with ringworm.

From information available, it is reasonable to assume that although ringworm had been recorded from Lautoka–Nadi before, the present outbreak had commenced from a variety of the disease which had entered through one of the above towns on harness which was brought in by members of the United States Army without the knowledge or consent of the local animal quarantine authority, i.e. the Veterinary Officer Western.

Inquiries from outstations and other islands of the group at this time indicated that the disease had not spread beyond the Ba–Tavua–Lautoka–Nadi districts except for 20 to 30 cases in Suva and Nausori, although there were indications that it was gradually spreading to areas where the horse population was high.

During the ensuing quarter the disease became established in the Nausori area where a survey showed 7·5 per cent incidence and had spread to the Sigatoka cane districts and Yaqara–Penang.

By the end of April the incidence in the Nadi area had been reduced to 50 per cent of those originally affected, but in Tavua–Ba the total incidence had risen to 90 per cent of horses. In Nausori the incidence was 65 per cent.

From this time until the end of July the disease appeared to be held and there were definite signs that in areas where officers of the Veterinary Division had been most active conditions had improved. This was noticed not so much in the reduced overall percentage of cases as the marked reduction of serious cases, which meant that horses which had been laid up because of the disease could, in a large number of cases, be returned to work. In areas where, because of shortage of staff or equipment the Veterinary Division could not be so active the

actual incidence increased, but there was never the same large percentage of serious cases as in the Ba–Tavua area.

On 19th July word was received from Nabouwalu that cases of apparent ringworm had been seen there, and on investigation it was found that about 15 animals were affected. At the same time unconfirmed reports had come from the island of Gau that the disease was present among cattle on that island. In spite of the most intense activity on the part of the Veterinary Division the number of cases in the Bua province increased and on 18th September cases were found at Savu Savu.

During the July to September period the incidence in the Western Districts of Viti Levu was greatly reduced due partly to Departmental activities and partly to the usual seasonal fluctuation. The incidence at this time was approximately 25 per cent in two of the areas, Baravu and Wailailai, where Departmental activities had been continuously carried out. Other areas were correspondingly low. Late in July the disease was reported and confirmed in Ovalau.

At the beginning of November the disease had entered the Macuata province from Bua and was advancing along the coast toward Labasa. The incidence in all areas during this quarter other than Ba–Tavua–Lautoka was reducing but in these three it showed an increase which gradually continued until by November the incidence was again up to 80–90 per cent. In the two previously noted areas, which may be taken as the areas of highest horse population, highest incidence, and greatest Departmental activity, the percentage incidence was as follows:—

	Baravu.	*Wailailai.*
Negative	10·0	2·6
Lightly infected ..	50·0	54·0
Heavily infected..	40·0	43·4

As a comparison, the incidence in the Rewa district for the 3rd and last quarters of the year was:—

	Third quarter.	*Last quarter.*
Negative	80	70
Infected	20	30

And in Sigatoka for the last quarter:—

Negative	90 per cent.
Lightly infected ..	7 ,,
Heavily infected..	3 ,,

At the end of December one case was reported from Taveuni and by mid-January 10 animals in Taveuni were suffering from the disease. During the first half of the year 1946, conditions in all areas except Taveuni were more or less static. In the case of Taveuni the disease increased in incidence. In March the island of Koro was found to be affected.

There has been the usual seasonal fluctuation during 1946 in all areas but none have become as badly affected as the Western districts where the horse population is high. On 28th April the Veterinary Officer Western confirmed that the disease was present on four horses on the island of Naviti in the Yasawa Group, but that it was absent from other islands of the Group.

During the third quarter of 1946 the incidence remained static in most areas where it had been present for more than six months. Some animals improved remarkably under treatment while others became infected. In Taveuni the incidence increased to 70 to 80 per cent. At the end of August six cases were reported from Kadavu by the Stock Inspector.

By the end of the third quarter of 1946 the following islands were known to be infected: Viti Levu, Vanua Levu, Taveuni, Koro, Gau, Ovalau, Kadavu and Yasawas.

DESCRIPTION OF THE DISEASE.

(*a*) *Horses.*—The first indication is that a few spots in the region of the withers become depilated. These depilated areas are circular and usually about one-quarter of an inch in diameter. They soon enlarge and coalesce forming an irregular mosaic. Soon a similar area commences on the poll extending to the ears and neck and involving the mane. The rump may become affected at the same time or later and in 7–10 days the whole of the top line is involved. The area extends down each side of the body to the level of the middle of the ribs, i.e. to the level where the skin is vertical. It seldom if ever extends beyond this level, so that the belly, legs, chest, and throat are never affected.

Coincident with the appearance of depilated areas, itching is observed which may be intense and as the animal scratches or rubs itself against any firm object the skin becomes broken, slight bleeding results and there is a coagulation of serum exudate. In areas where scratching does not occur, the skin does not break, but the cornified epithelium desquamates in large flakes. These may be up to three inches across. After desquamation new hair grows on the bare areas often of a darker colour than the original coat. At the same time, however, new patches appear in adjacent areas and the disease may spread over the whole of the susceptible area, including the butt of the tail.

Sometimes large areas, particularly on the head and face become completely denuded of hair and a thick crust formation develops. In these areas itching is not usually apparent. When the ears become involved, the rubbing and scratching produces subcutaneous abscesses, which may affect the cartilage and permanent distortion of the ear may result.

Recovery is seldom rapid to completion. With treatment, rapid recovery is often noticed to the stage where only a small area on the withers remains, but this persists for a long time in spite of treatment.

In the Table all cases, including those having only one small spot, are recorded.

(*b*) *Cattle.*—The disease appears to be confined to the withers, neck and head. The incidence is usually below ten per cent and crust formation and wrinkling of the skin are more marked.

(*c*) *General.*—Although conforming in general to the condition as described in other parts of the world, there are a number of points on which the local disease differs. Perhaps the most important of these is the manner in which animals remain with a very small area of infection on the withers which persists in spite of intense treatment. This is shown both in animals which may become heavily infected and then recover till only a very small area of infection remains, and in animals which are only slightly affected *ab initio*. A second point of difference is that young animals are very seldom affected and even in areas where the incidence is extremely high and contact is close and frequent, they usually remain unaffected.

Effect of Seasonal Conditions on Incidence.

There is strong evidence to indicate that temperature and humidity favour the disease. From October 1945 until the present time, an accurate check on a number of cases, and degree of infection was kept in the Ba–Tavua area, and the results tabulated in the table. This indicates that the hot wet months, November to March, favour the disease and there is a distinct improvement in the April–July period. From various sources there is evidence which shows that where the temperature has remained low and there has been little rainfall a marked improvement has resulted.

Method of Spread.

There is no need for direct contact to occur in transmission from one animal to another. The spores of ringworm will remain viable on saddles and other harness and it is known that transmission can occur by such means. In addition, as will be seen below, there is very strong evidence to show that spores can be carried by birds or may be wind-borne. It is the habit of mynahs and other birds to perch on the withers and backs of horses and cattle and as this is the predilection site of the disease it is apparent that this is a very potent source of spread. It is known from information available from other countries that the spores can be carried for long distances by the wind and they may be blown from an affected horse to an unaffected horse some miles away. In most country districts the natives habitually ride without saddles. The danger of them so carrying spores on their clothing for very long distances is so apparent as scarcely to need further comment.

Predisposing Causes.

Animals in a poor state of physical well-being are far more susceptible to the condition than healthy and well conditioned animals. Consequently the disease is much more difficult to deal with in areas where

peasant farmers do not make adequate grazing or feeding arrangements. It is considered that one of the major reasons why the disease did not flourish in the Rewa area to the same extent as it did in the Ba–Tavua areas is because of the greater availability of adequate grazing in the former area.

In addition to a sub-optimal nutritional level it is known that infestation with intestinal parasites or other weakening disease conditions will predispose an animal to ringworm.

ACTIVITIES OF THE DEPARTMENT IN COMBATTING THE DISEASE.

Since it was first noticed to be more than usually prevalent, officers of the Veterinary Division have been most active in dealing with the disease. From February 1945 until the end of the year most of the Division was working full time on combative measures.

(*a*) *Legislation.*—Under the Animals (Contagious Diseases) Ordinance the Governor in Council may make regulations in connexion with any disease which is declared a disease under the Ordinance. In this regard ringworm was declared a disease on the island of Viti Levu on 2nd March, 1945, and regulations were made prohibiting any animal from leaving Viti Levu without the written consent of the Senior Veterinary Officer or an Inspector under the Ordinance. Powers were given also to order musters and treatment to be carried out. The same was applied to the Province of Bua on 14th August, 1945, and with the spread of the disease beyond the Bua border this was extended to include the whole of Vanua Levu on 28th September, 1945. When the disease was recorded on Taveuni, Koro and Ovalau these islands were included in the declared areas.

(*b*) *Activities in the Ba–Tavua and Lautoka–Nadi areas.*—Up to the end of 1944 the Veterinary Officer Western working with the Stock Inspector Ba, and Native Veterinary Assistants dealt with cases brought to their notice by hand application of dressings known to be curative in effect.

In January 1945, as a result of a conference at which the Acting Senior Veterinary Officer, members of the District Administration and officers of the Colonial Sugar Refining Company were present, a large scale campaign of treating horses with hand-sprayers was begun. At first this applied only to the Ba–Tavua area, and 12 centres were defined where stock could be brought once weekly for treatment. In this way 22,242 treatments were given by officers of the division by June 1945. In addition lotions were supplied to a large number of peasant and other farmers who were able to treat their horses at home. By this means the incidence of the disease was definitely reduced but due to the great difficulty experienced in obtaining co-operation from individual farmers, no striking results were achieved. However, the relative success obtained was sufficient to allow of a certain number of farmers being exempt from regular attendance at muster points provided they treated their stock at home with lotion supplied by the Department.

In April, in response to requests from various farmers in the Lautoka area, seven centres were set up between Drasa and Sabeto where lotion could be obtained once weekly. Up to the end of June the response from farmers had fallen off to such an extent that the centres were closed down soon after. The Veterinary Officer Western reports that on June 28, on visiting the seven centres, only two farmers availed themselves of the opportunity of obtaining lotion.

With the easing off of hand-spraying and hand application of lotion in all the above areas after June, efforts were directed more at inspections at musters, distribution of lotion to farmers and tours of inspection. In this way many thousands of individual examinations were made and quantities of lotion equivalent to the treatment carried out by officers of the division in the January–June period were dispensed to farmers. By this means in the Ba area where the compulsory mustering of horses at intervals of five weeks was carried out 5,262 horses were dealt with. Inspections and distribution of drugs continued in this manner until July, 1946, when in view of the improvement of the general position it was decided to maintain compulsory musters on a three monthly basis.

Although it cannot be claimed that the overall percentage of cases has been reduced by the above action, it is clearly indicated that the number of cases serious enough to warrant the animal being taken off work was greatly reduced. As against this it is to be clearly understood that, even at the height of the campaign there was a large number of horses which, through lack of staff, inaccessibility and wildness of the animals, were never contacted, and which served as a constat reservoir of re-infection.

(*c*) *Activities in the Eastern Districts of Viti Levu.*—In February 1945, when the disease was found in the Rewa area, horses were inspected, the extent of the outbreak established, and treatment commenced. Seven collecting centres were established and an average weekly muster of 630 animals was arranged. By June 1945, a decrease in the number of animals affected was noticed and there was a marked improvement in the animals treated. Co-incident with treatment at musters, lotions were made available to farmers at the above centres and although at the beginning great enthusiasm was shown, by October attendance had fallen to about 25 per cent of the original. The centres were continued however, and treatment made available to farmers until November 1945, although no compulsory musters occurred after July.

After November, efforts were concentrated on widespread inspections, instructions regarding treatment, or actual treatment by officers rather than compulsory musters. This was considered more appropriate in view of the fact that a number of horses being brought into musters were found to be free from infection, and chances of their being re-infected by close contact with infected horses were so great as to render musters sources of spread rather than of control.

At no time did the disease become as serious in this area as in the Western Districts, and the few serious cases observed during 1946 have been adequately dealt with by Veterinary staff during the course of routine inspections.

In other areas of the Eastern Districts inspections were carried out from time to time and where necessary treatment ordered, or carried out by the officer concerned. This applied in Tailevu, Colo East and Navua. In none of these areas has the disease become a serious economic factor but in dairying areas where a number of cattle have been affected appropriate steps have been taken to deal with it.

(*d*) *Activities on Vanua Levu.*—On receipt of information (19th July, 1945) that the disease was seen at Nabouwalu immediate arrangements were made for the Senior Veterinary Officer to visit the area and by the end of the month the 15 horses found affected were concentrated on a paddock at Nabouwalu, specially constructed to contain them. Arrangements were made to prevent other stock from approaching the quarantine paddock. The original 15 animals were found in various centres, the furthest north being at Nasarawaga. No cases were seen further round the coast toward Cakaudrove. Although at this time no animals could be found as far north along the coast as Dreketi and although a most thorough and continuous inspection of the affected area was maintained, the disease repeatedly broke through the quarantine boundary until cases were found at Dreketi. At this time a Police Patrol was maintained along the Bua border and Dreketi River, with two headquarters, one at Dreketi and one near the Yanawai River. By 25th August 65 animals—horses and cattle—were quarantined at Nabouwalu and the disease was cropping up in practically every centre in the province until it was estimated that 150 animals were seen. Consequently the quarantine at Nabouwalu was abandoned and a concentrated effort by Police and Veterinary staff was made on the border of the province. One of the factors in deciding against continuing with the Nabouwalu quarantine was the fact that rice farmers were desperately in need of their animals for work and none of the animals were so seriously affected as to warrant their being prevented from working.

On 7th September a report was received that infected animals were seen at Savu Savu. This was confirmed by Veterinary staff on 18th September and by 21st September a Police patrol of the Cakaudrove–Macuata border was in operation in addition to that between Bua and Macuata. Headquarters

for this patrol were Nayarabale and Korotari.

These patrols functioned most effectively and everything possible was done to prevent the further spread of the disease, but nevertheless, on 1st November a number of cases were seen close in to Labasa. By the 12th November the disease was reported over a wide area in Macuata and on 15th the Police patrol on both borders was lifted. During the period July–November, officers used every effort in treatment, prevention of movement of stock and fittings and advice that was possible, and it is significant that in spite of this and in spite of every assistance from farmers the disease could not be prevented from spreading. It is to be noted however, that the disease was prevented from spreading to Macuata for two months due to the effectiveness of the border patrols and the activity of officers in preventing animals approaching the borders.

From November 1945 until the present, cases have been dealt with by Departmental officers as they have been encountered and the normal staff in Vanua Levu has been re-inforced to maintain as thorough an inspection and treatment service as possible. Although the disease is widespread the number of serious cases is not great and no great economic loss is being experienced.

The foregoing details regarding quarantine measures lend force to the hypothesis that the spores are carried for long distances by vehicles which it is impossible to control. Such vehicles are birds, the wind, and the clothing of people coming into contact with diseased animals.

(*e*) *Activities on other islands.*—In the case of Taveuni visits were made on two occasions by officers of the Veterinary Division, inspections were carried out, advice given and dressings made available. On other islands, after confirmation of the presence of the disease activities were restricted to advice and forwarding of dressings.

(*f*) *Types of treatment used.*—In view of the large number of animals affected it was essential to have available a lotion or dressing which was easy to get, cheap and effective. The innumerable pharmaceutical remedies which were known to be quite effective all suffered from the same two defects; (*a*) because of the war they were in short supply and (*b*) they were far too expensive for the peasant farmer to use in the required quantities.

In the early stages a mixture known as Cozsal and containing Brilliant Green was used but when it was found necessary to spray large numbers of horses a lime-sulphur mixture containing 12 lb lime and 30 lb sulphur per 100 gallons, was used. This was found to be quite effective in curing the condition to the stage where only a few small areas remained, but it was found that if rain fell soon after application the mixture was washed off. Later a mixture of coconut oil and dieselene—50 per cent of each was found to be both easily obtainable and effective and this has been the standard remedy for most of the animals treated. In the Western Districts this was found to cause a certain amount of sloughing in a few cases and the dieselene was reduced to 25 per cent. In the other districts the 50 per cent mixture was found to be more suitable. At various times individual animals were treated with other mixtures, the most promising of these being an ointment containing salicylic acid. Coconut oil alone was found effective when dieselene was not available. Bathing in the sea, or washing with sea water usually had a distinctly beneficial effect and where farmers lived close to the sea this was frequently carried out.

(*g*) *Subsidiary Controls and Activities.*—At all times the most rigid control possible of all animals, harness and fittings and other material likely to carry the spores has been enforced in connexion with transport from infected to non-infected areas. This has resulted in a certain amount of inconvenience to the public and on some occasions has held up free trade and communication. However, such control was so effected as to interfere as little as possible while still leaving no opportunity for the disease to be transmitted. As new areas became infected the restrictions between such areas and infected areas were immediately lifted. Close contact was maintained with Police officers concerned with shipping in the prevention of unauthorized carriage of harness and saddlery from infected to non-infected areas.

(*h*) *Education of the Public.*—Efforts have been continuously directed at keeping the public informed of matters relating to the disease. This has been carried out over the air, in the press, in the *Agricultural Journal* ([1], [2]), in circular communications and by personal contacts between officers of the Department and members of the public. Every effort has been made to acquaint the public of the importance of the disease, its rapid and uncontrollable spread and measures to be adopted in combatting it. Wherever possible officers have given demonstrations and talks to groups of farmers and in general bent every effort to keep the public informed on the disease.

ECONOMIC IMPORTANCE OF THE DISEASE.

Although by no means in the same category of diseases as the highly infectious tropical diseases of animals encountered in Africa and elsewhere, the disease did have serious economic repercussions in areas where the incidence was high and the majority of cases well advanced. There have been no cases of death occurring directly from the disease but the number of days lost from work and the falling away in condition has resulted in considerable economic loss to the Colony.

Nevertheless, even if it were possible, the expenditure of some scores of thousands of pounds on carrying out an extremely rigorous campaign of isolation, destruction of affected animals, and compensation to owners would scarcely seem to have been warranted, if only because of the constant source of infection to be found in the large reservoir of wild animals roaming at large in the hinterland of the districts in which the greater economic loss has been felt.

As envisaged by the technical staff of the Department in the beginning and as is being borne out as the disease progresses and finds its level in relation to its host animals, the expenditure, of say £100,000 on combative effort, at that unsuccessfully, on a disease the economic significance of which is only say £10,000 in the ultimate analysis, seems unwarranted.

It is to be borne in mind also that the economic loss to the Colony from the effects of internal parasites on livestock is immeasurably greater than the economic loss from ringworm. The fact that internal parasites are unknown to the general public and cannot be plainly seen, does not make them any the less serious, as compared to ringworm which is known and is easily seen.

ATTITUDE OF THE FARMING PUBLIC TO THE DISEASE.

As is usual with a new disease, farmers, and particularly peasant farmers were inclined to treat the disease with the seriousness which its importance warranted. When it was seen that deaths from the disease were unlikely and, that provided the animals did not become seriously affected they could still be worked, this attitude deteriorated until in the majority of cases an immutable apathy set in which, in spite of coaxing, pleading, threats, or prosecution, could not be overcome by Government officers. This militated seriously against the work of the officers and handicapped the efforts of those few who carried out the advice and instructions given. It is impossible for a farmer to maintain his stock free of the disease by treatment and prevention when his neighbour, who does nothing to control the disease in his animals acts as a constant source of re-infection.

Such a state of affairs was most noticeable in the Ba–Tavua area, again the area in which the Department was most active. In Vanua Levu on the other hand and particularly in Bua province the co-operation of the farming public was so enthusiastic as to be almost an embarrassment. This different attitude on the part of the two groups of farmers is more significant when it is seen that in the Bua province the serious cases now encountered are so few that practically no economic loss is now felt.

In all areas where they are concerned, the Colonial Sugar Refining Company has shown the most lively interest in the disease and has worked in the closest co-operation with officers of the Department. It may safely be said that without the assistance of this Company the campaign in Ba–Tavua could not have been carried out to anything approaching the same extent.

The assistance of the Police was at all times freely given and was of the greatest value to officers of this Department.

TABLE SHOWING NUMBER OF HORSES INFECTED, DEGREE OF INFECTION, AND PERCENTAGES, 1945–46.

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April.	May.	June.	July.
Negative	142	22	13	34	41	69	77	181	127	110
Light	790	581	334	475	455	545	769	774	749	776
Heavy	515	875	1,106	814	870	867	432	360	434	407
Total	1,447	1,478	1,453	1,323	1,366	1,481	1,278	1,315	1,310	1,293
Percentage affected (Total)	90·2	98·5	99·1	97·4	97·0	95·3	94·0	86·2	90·3	91·5
Percentage affected heavily	35·7	59·2	76·6	61·4	63·7	58·5	33·8	27·4	33·1	31·5

It is to be stressed that horses graded as heavily infected are those showing more than a few spots in the region of the withers or head. The very serious cases would be only a small proportion of these.

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REPORT ON CASTOR OIL

BY B. E. V. PARHAM AND P. L. R. CHARLTON

I—INTRODUCTION.
II—THE CASTOR-OIL PLANT IN FIJI.
III—CULTIVATION AND SOILS.
IV—HARVESTING AND YIELDS.
V—EXTRACTION AND USES OF OIL.
VI—REFERENCES.

I—INTRODUCTION.

During recent years there has been a number of inquiries from overseas regarding the prospects of supplies of seed of the castor-oil plant being produced in Fiji. In 1940, samples of local seed were submitted to manufacturers in Australia who reported that although its oil content was not quite as high as that of Indian seed, they would nevertheless be prepared to purchase. It was considered then that a price of approximately £11 10s. 0d. per ton Australian currency would be payable to the exporter at Suva and that quantities up to 50 tons per month could be absorbed. Efforts made by the Director of Agriculture to stimulate the interest of Fijians in the collection of seed were unsuccessful mainly owing to floods during 1941 which destroyed many plants growing wild in the valley of the Sigatoka River. Also no exporter could be found to take an interest in the collection and handling of this product.

In 1942 advice was received that a price of £19 Australian currency could be paid and that conditions were such that a considerably higher price of £25–£26 might be available.

No further action appears to have been taken and as inquiries have recently been renewed the following notes have been prepared for those who may be interested in the production and marketing of this commodity.

II—THE CASTOR-OIL PLANT IN FIJI.

The first introductions of the castor-oil plant to Fiji appear to have occurred before 1860 as the plant is recorded both by Seemann[1,2] and Horne[3] as being naturalized and known to the Fijians as "Bele ni Vavalagi." It has spread to most parts of the Colony and is particularly plentiful along the banks of the main rivers (Sigatoka and Rewa) and along the coastal areas (Nadroga, Navosa) where the self-established plants often extend in pure stands of a quarter to half an acre in extent on lower banks of the rivers: a rough estimate of the total area in the Colony is extremely difficult to arrive at owing to the scattered distribution of these stands. It is possible that some 500 or 600 acres would accommodate the existing plants.

In 1925 attention was drawn to the potentialities of this plant by an article which appeared in the *Fiji Times and Herald* on the 15th January and later in the

Agricultural Circular(4). The variety which is naturalized and widespread in the Colony is the smaller annual one—which gives a small seed and a better quality oil than the large tree perennial form. There is no doubt that seeds of this plant have been introduced at various times but actual records are few.

In 1943 seeds of two selected varieties were introduced from the Drug Experimental Station of the Department of Scientific and Industrial Research, New Zealand, and both grew with success at Naduruloulou(5).

III—Cultivation of Soils.

The plant is a hardy one, well suited to tropical conditions, and is easily propagated from seed. It thrives on light alluvial or sandy soils, and the best yields are obtained in areas of lower rainfall. The climate of the Northern and Western Districts of Ra, Ba, Nadi, Nadroga and Navosa in Viti Levu appear to be well suited and it is in this climatic belt that the wild plants are to be found in greater numbers.

Planted seven to eight feet apart it takes 15 to 20 pounds of seed of the small variety to plant an acre—the usual practice is to treat the crop as for cotton—sowing a few seeds in each site at distances of six by six feet, or eight by eight feet in good soil, and thinning out to one plant. The main stem is nipped back to induce fruiting branches; and little attention other than necessary weeding is required. The plant is subject to no serious pests and diseases although the leaves are occasionally attacked by caterpillars. Lever(6) records damage to the foliage by caterpillars of *Achæa janata* L. and of *Thalassodes pilaria* Guen. Planting would best be commenced at the beginning of the rainy season (November and December).

IV—Harvesting and Yields.

In Ceylon yields of approximately 560 lb per acre have been recorded. In Bengal the yield of clean seed is said to be 250 lb per acre when grown with other crops and 500 to 800 lb when grown alone. It has been suggested that castor bean could well be grown with peanuts as a mixed crop.

In Fiji yields of six pounds per plant from wild, and 14 pounds from cultivated plants, have been obtained. It is known that yields vary considerably from 4–20 lb per plant per annum. Harvesting is not a difficult operation; the capsules are collected when the calyces turn brown. The fruits mature unevenly and the dried spikes are collected into a heap on a dry covered floor and covered with straw or sacks. After a week these capsules soften, the shells decay, and when exposed to the sun, split open to release the seed. The process can be assisted by beating with a stick.

The perennial tree type of castor bean grows to a large size reaching 12–16 feet in height with wide spreading branches, but in proportion to the area occupied does not yield so heavily as the small variety.

V—Extraction and Uses of Oil.

The clean seeds are husked before crushing for oil and contain nearly half of their weight in oil, the usual extraction being about 40 per cent of the total weight. Thus 100 pounds of castor beans give: husk, 20 pounds; oil, 40 pounds; and cake, 40 pounds. On this basis an average crop of castor beans computed to yield 500 pounds of seed would yield 200 pounds of oil and 200 pounds of cake. For the production of the best quality oil (for medicinal purposes and for lubrication) the seeds are decorticated before being expressed in the cold. The press cake is broken up and subjected to a second and third expression at a higher temperature; but the oils so obtained are unfit for medicinal use and are employed for technical purposes (soap-making, manufacture of Turkey-red oils, lubricating oils, etc.). The lowest grade oil is obtained by solvent extraction (usually with carbon bisulphide) from the final press residue.

The principal by-product is the oil cake which has poisonous properties and cannot be used as cattle feed. It is rich in nitrogen and is a valuable fertilizer.

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SOIL INVESTIGATIONS, FIJI—PART 6

OBSERVATIONS ON CERTAIN SOIL TYPES AT TOGA, REWA

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[In 1940, owing to the urgent necessity of increasing rice production as a general defence measure, an area of some 1,433 acres of swamp land in the Toga District, Province of Rewa, Viti Levu, was placed under the control of the Director of Agriculture for exploration and development. Staff shortages delayed surface and soil surveys.

In 1941(1) the Director reported that 117 acres on the fringes of the area had been planted with rice by 73 tenants and that a survey of levels to establish drainage lines was awaited.

In 1943(2) progress was recorded; 230 acres had been prepared by 207 tenants and 100 acres of this planted.

It was not until 1944 that a surveyor was available to prepare a suitable plan of the area including contours of one foot intervals which could provide essential basic data for a soil survey which was commenced in December 1944 and completed in February 1945. The field and laboratory data obtained by the authors is of considerable practical and scientific interest, as the following extract from their report will show.

Ed. *Agric. Jour.*]

INTRODUCTION.

The area covered by this survey comprises some 1433·2 acres of swamp land known as N. 34 on the Native Lands Commission Survey Sheet. The area is enclosed within a line drawn from the point of intersection of the King's Road with the Nasinu River, thence following the King's Road northwest to the Rewa River, thence southeast following the right bank of the Toga Creek to its confluence with the Rewa River thence following the right bank of the Rewa River to its mouth, thence west to the mouth of the Nasinu River, thence northwest along the left bank of the Nasinu River to its intersection with the King's Road.

AGRICULTURAL HISTORY OF THE AREA.

The area with which this survey is more particularly concerned has never been grazed or cultivated within living memory. Cane is cultivated outside the area on the higher land (the Rewa alluvials) to the north-west but has never extended beyond a narrow strip in relation to the main river. During inquiry statements were made to the effect that consideration had been given to the extension of sugar cultivation but the cost of drainage and the peaty nature of the soil had deterred such activities. No evidence was adduced to the effect that the area had ever previously been considered as a rice scheme.

GENERAL FIELD INFORMATION.

(1) *Climate and Topography.*—The climate of the area is typical of the wet zone of Viti Levu and rainfall distribution and the number of wet days is similar to that of Suva. No specific meteorological information was available. The area is flat in topography with a few hillocks arising a few feet above the plain.

(2) *Geology.*—Although the basement was not reached during the survey it is probable that this is marl forming a sloping platform upon which has been deposited several hundred feet of sediments. Evidence secured during the construction of the Rewa Bridge lends support to this view. Subsequently by the shifting of the channel of the Rewa River the area was converted into

a slow-draining lacustrine basin into which poured sediments in the form of sands from the surrounding hills. As the region became shallower, lacustrine growth became possible with the formation of peat. It is this material in varying stages of development and in admixture with fine sands and silts that constitutes the parent material for the soil of the region. That the later sedimentary sands have not been transported far is indicated by the angularity of the grains.

(3) *Vegetation.*—The vegetation of the area is typical of swamp associations in the low-lying swampy areas of Eastern Viti Levu and to a large extent determines the soil types with which they are associated. The silt-sand type is associated with secondary bush containing vau(1), ivi(2), lantana(3), sedges(4), pandanus(5), mimosa(6), creepers(7) grasses(8) and a few trees. On the organic-sands the pandanus is more scattered and the dominant types of vegetation are water weeds, sedges and mosses(9). Para grass and trees with a few water weeds characterize the sand-silt-clay soil type.

(4) *Access.*—The King's Road passes across the higher land over-looking the Toga flats and a secondary road which meets the 9-mile mark gives easy access to the area. The area may also be reached from the 7-mile mark on the King's Road by a gentle track and a pontoon across the Nasinu River. The area can therefore be approached from both extremities, although further developmental work would necessitate some expenditure on roading.

SOIL SURVEY.

A study of the topography and vegetation of the area suggested that six types were probably present and accordingly six profile pits were prepared on selected sites.

(1) *Hibiscus tiliaceus* Juss.
(2) *Inocarpus edulis* Forst.
(3) *Lantana aculeata* L.
(4) *Cyperus pennatus* Lam.
(5) *Pandanus tectorius* (Sol.) Rumph.
(6) *Mimosa pudica* L.
(7) *Ipomoea* spp.
(8) *Brachiaria mutica* Stapf., *Paspalum orbiculare* Forst. and others.
(9) *Sphagnum cuspidatum* Ehrh.

A careful study of the profiles indicated that in effect there were three types only and the general similarity of the profiles suggested one series which we have designated " Toga Alluvial Series."

The sub-division of the area by the Lands Department surveyor gave sufficient fixed points to permit the mapping of soil boundaries on a scale of four chains to one inch. In all, 307 core samples were observed during the survey and soil boundaries were demarcated by compass traverse and chaining.

Many phases of these soil types were observed during the survey, such as differences in thickness of peat layer and slight variations associated with topography and vegetation; neither the scale nor purpose of the survey permitted closer mapping.

Owing to the thickness of the peat layer at many stations it was necessary to construct special soil augers which permitted the easy attachment of extension rods.

(1) *Type Silt-Sand.*—This soil type which covers approximately 407·4 acres of the area surveyed is clearly defined. The general picture of this type shows a surface layer of a dark brown friable loosely compacted sandy loam of from 4¾ to 11 inches; followed by four to eight inches of a light brown almost structureless loosely compacted sandy loam; followed by eight to 24 inches of a yellow brown to grey blue structureless sand; followed in depth by sands which show deposition boundaries.

The rapid increase in coarseness of texture is clearly displayed by a study of the mechanical analysis depicted in Table I.

The mechanical analyses were performed by the beaker sedimentation method and accordingly the clay fraction is weighted by organic matter which occurs in some quantity in the surface and sub-soils. The loss on ignition of the dry soils gives figures varying from 6·43 to 13·27 per cent and since the field index of texture does not suggest clay, these figures can be attributed to organic matter.

The pH of the soils is uniformly acid; the nitrogen content of the surface soil in keeping with the organic contents is relatively high; available P_2O_5 is extremely low and total P_2O_5 moderate to low.

TABLE I.
LABORATORY DATA.

	Soil No.	C.S. %	F.S. %	Silt %	Clay %	pH.	Loss on Ignition %	Org. Cal. by (Nx20) %	Nitrogen %	Av. P_2O_5 p.p.m.	Total P_2O_5 %
Profile I ..	582	24·15	40·88	12·88	22·01	5·09	6·43	2·16	0·108	less than 10	0·085
	583	27·64	43·57	8·75	19·88	5·45	...	...	0·082	„	...
	584	34·87	40·58	8·72	15·89	5·81	...	...	0·099	„	...
	585	40·61	39·43	7·46	12·55	5·67	...	...	...	....	...
	586	64·01	11·56	21·79	2·63	6·07	...	...	...	....	...
	587	50·56	43·76	3·21	2·46	6·17	...	...	...	....	...
Profile J ..	588	2·28	34·13	17·77	47·44	5·28	26·71	9·77	0·489	„	0·158
	589	2·78	50·61	15·13	31·57	5·16	....	...	0·084	„	...
	590	3·76	64·35	7·74	22·02	5·64	...	...	...	....	...
Profile K ..	591	11·28	46·57	12·93	29·14	5·50	9·23	4·10	0·205	30	0·104
	592	12·56	47·85	12·91	26·75	6·12	...	...	0·056	12	...
	593	19·84	54·68	8·54	16·92	6·70	...	...	...	....	...
	594	21·25	68·35	4·15	6·32	6·63	...	...	...	....	...
	595	28·88	64·01	4·31	2·87	6·84	...	...	...	....	...
	596	6·63	89·91	2·00	1·50	5·60	...	..	...	....	...
Profile L ..	597	...	13·65	22·35	...	4·39	59·73	23·52	1·176	21	0·126
	598	...	4·01	19·65	...	...	86·65	33·34	1·667	122	...
	599	12·91	46·11	12·20	29·89	...	...	...	...	....	...
	600	18·81	49·44	12·17	19·55	...	...	...	...	....	...
Profile M ..	601	10·97	44·85	11·83	32·07	4·39	13·27	6·65	0·333	less than 10	0·108
	602	12·68	54·49	11·09	21·70	4·03	...	...	0·052	„	...
	603	16·81	70·51	6·63	6·01	4·72	...	...	...	....	...
	604	15·48	72·71	7·77	4·07	5·06	...	...	...	....	...
Profile N ..	605	1·05	16·37	18·21	64·40	5·26	22·17	6·80	0·340	„	0·042
	606	1·22	13·17	17·98	67·67	5·28	...	...	0·669	„	...
	607	3·15	35·21	17·06	48·62	4·17	...	...	...	....	...
	608	2·63	28·65	25·63	42·97	4·43	...	...	...	....	...
	609	4·99	54·93	15·17	24·97	4·97	...	...	...	....	...
	610	2·97	75·42	11·67	10·03	5·00	...	...	...	....	...

NOTES.—C.S.F.S.—refer to coarse sand and fine sand respectively.

Org. Cal by (N x 20) refers to organic matter calculated by multiplying the nitrogen percentage by 20. This figure holds in general terms on the assumption that the carbon figure for humus is constant. Since the organic matter of these soils is not strictly humus these figures have qualitative significance only but are in the same order as the loss on ignition.

Av. P_2O_5 p.p.m.—This refers to available phosphate in parts per million of soils.

(2) *Type Organic-Sand.*—This soil type occupies approximately 1007·5 acres of the area surveyed and is defined as follows:—

A black to black brown structureless, semi-peaty, spongy, partially decomposed organic mass of some eight to 11½ inches and containing a proportion of sandy silt in the lower half of the section, is followed by seven to 28½ inches of similar material containing a higher proportion of silty sand. The end of the section merges without clear demarcation into a structureless blue grey sand containing roots of vegetation and varying in depth from 8½ to 20½ inches. This last horizon lies directly on blue-grey-green sand of unknown depth.

The mechanical analyses determined by the beaker sedimentation method on the air dry sample does not give a true indication of the clay figure. The high organic content of soils 597 and 598 of profile L did not permit a determination of the clay figure but the loss on ignition of the air dried soils was respectively 59·73 per cent and 86·65 per cent. The nature of this material is shown by the fact that it lost 90 per cent of its weight on drying at 100°C. and a 1 ft. x 1 ft. x 3 ft. section which was handled with difficulty on removal from the field shrank on air drying to about one-third of its former size and could be lifted without effort.

These soils are acid and the high nitrogen contents are indicative of the high proportion of organic matter present. With the exception of sample 598 which has a fair content available P_2O_5 is extremely low: total P_2O_5 is fair to good.

(3) *Type Sand-Silt-Clay.*—This soil type of approximately 18·3 acres occupies a relatively small portion of the total area. Its nature is defined by the detailed study of profile N. Sixteen inches of a brown to orange-brown slightly compacted clay is followed by 14 inches of a more compacted similar material. Sandiness increased with depth until at 59 inches the dominant texture is sand. As with previous types these soils are acid and low in available and total P_2O_5. The nitrogen content of the soil is in keeping with the presence of organic matter as described in the profile. The loss on ignition of 22·17 per cent cannot be used to support the finding as in previous cases since a great deal of this loss would be accounted for by the combined water of the clay.

DRAINAGE AND IRRIGATION.

From a study of the one foot contour lines, the area surveyed has a fan-shaped appearance, the natural drainage lines appearing to flow from the east by north to the west by south along depressions to the Wainibuka Creek. On the completion of the soil survey, it became apparent that the area was divided into two unequal sections by a low watershed running north-north-east to south-south-west, the smaller of about 500 acres draining along natural depressions with little fall to the Wainibuka Creek, the larger of about 966 acres draining to a depression bordering the high alluvial flats on the western bank of the Rewa River the outlet being near Lokia village. Thus, if the drainage of the area was contemplated, two parallel systems would be required.

The apparent discrepancy between the fall of the area as determined by surface contours and the actual fall after soil survey is due to accumulations of partially decomposed organic matter overlying sand. The accumulations vary in depth from a few inches adjacent to the watershed to a maximum measured depth of 11 feet 10 inches. It is estimated that this layer would shrink to a few inches on drainage and mineralization of organic matter.

The majority of the 1,433 acres surveyed lies between the seven foot and fourteen foot contour lines; these lines are based on mean high water mark. One thousand and seven acres of the area are made up of soil type organic-sand, which is characterized by an organic layer of varying depth which on shrinkage would materially lower the present surface level. On the thirteen foot contour line on the above-mentioned soil type one core sample showed the organic layer to have a depth of eight feet eight inches. This would shrink to perhaps six inches on drainage. The resultant surface level would be four feet 10 inches in a drain of say two miles in length through sand, an impracticable fall. On the fourteen foot contour the depth of the organic layer was 11 feet 10 inches; this would give on drainage a possible fall of three feet in two miles of drain, another impracticable fall.

In view of the fact that the soils are predominantly sands, three-fifths of which are covered by partially decomposed organic plant remains of varying depth, and the necessity of having two parallel drainage systems, the drainage of the area would be most costly and would be out of all proportion to the value of the area when reclaimed. Further, on reclamation, there would be left a structureless sand, totally unsuited to rice cultivation requiring substantial expenditure annually on maintenance and subject to heavy flooding with resultant erosion, scouring and damage to the drainage system.

Irrigation of the area is economically impracticable due to the main soil types being sands.

RICE YIELDS.

Records of areas planted under rice by lots in the 1943–44 and 1944–45 seasons have been obtained together with records of yields of padi. With few exceptions, the yields of padi from all soil types have decreased in the latter season as compared with the former. The percentage decrease varies from a few per cent to over 50 per cent in a few instances. This general

decrease cannot be attributed to adverse weather, pests or diseases. Table 2 indicates the decrease in production being the yield data for 10 lots selected at random.

Table 2.

Lot No.	Yield of padi in lb per acre.	
	1943–44.	1944–45.
2	970	580
41	1,541	1,080
54	1,170	1,080
84	1,750	1,480
B 2	1,521	870
9	1,471	1,470
A39	1,860	1,210
55	1,620	1,080
E15	1,780	810
F51	1,800	671

General Discussion.

From a consideration of the field and laboratory information presented in this report there is strong evidence to suggest that the area is unsuitable for further development.

Of the area surveyed, namely 1433·2 acres, some 1007·5 acres consists of the organic-sand soil type which is definitely unsuited to rice cultivation irrespective of drainage problems. The area covered by this type in the region surveyed is approximately 70 per cent of the whole, and a general reconnaissance over the whole area available, namely about 2,500 acres, indicates that the same general position pertains.

The soil type silt-sand, of some 407 acres, could possibly be used for rice cultivation provided that heavy irrigation together with intensive drainage is feasible and provided also that manurial treatment is made a feature of the cultural programme. Evidence is presented to the effect that both drainage and irrigation is economically impracticable.

The sand-silt-clay type is suited to rice cultivation but the extent of this type is negligible in comparison with the other types.

The laboratory data shows that the soils are deficient in available phosphates, are in general moderately acid to acid and that the nitrogen figures, although high, in conformity with the organic content falls off rapidly with increasing sand content as the profile is descended. The total P_2O_5 is only moderately fair. The chemical evidence in general indicates that nutrients are associated with the organic content of the soil. This will rapidly disappear with drainage and crop exhaustion, necessitating an expensive manurial regime in cultural operations.

That the nutrient status of these soils is not satisfactory is indicated by rice yields presented in a previous section of this paper. To recapitulate, it will be sufficient to draw attention to the fact that under comparable environmental conditions rice yields have fallen as much as 50 per cent in two seasons, particularly on the organic-sand type.

Above all other considerations of limitations to further development are those of drainage. Two parallel lines of drainage are necessary and owing to the flat topography of the area and falls of about four feet 10 inches in a drain through sand of two miles in length, the situation is one which could be dealt with only by expensive engineering works.

Even with drainage, the nature of the soil is such as to require constant heavy irrigation throughout the growing season. It is true that water could be pumped from the Rewa River but the salt content in that portion of the river below its junction with the Waimanu is such as to necessitate over five miles of main canal. This would be a costly procedure for a relatively small area of land.

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COPRA PRODUCTION AND GRADING, 1946

With the demobilization of the Fiji Military Forces completed early this year, labour conditions on copa estates were considerably improved, native plantations received more attention which with shipping facilities more frequent and improving prices for copra, resulted in an increased production of some 33 per cent over the previous year's figure, production reaching 28,639 tons as against 21,500 tons.

Grading was carried out at the various ports as follows;—

	Bags.
Suva	190,866
B.S.I.P. and Gilbert and Ellice Islands through Suva ..	12,601
Levuka	161,096
Savu Savu	33,870
Rotuma	31,155
Total (28,639 tons) =	429,588

Efforts to improve quality by maintaining a price differential of 30s. per ton in favour of plantation grade did not meet with the success it deserved, due no doubt to some extent to the deterioration of drying facilities owing to lack of essential materials to maintain them in efficient order. After due consideration by the Copra Committee, it was decided by a majority vote to revert to the price differential of 5s. 6d. per ton allowed by the Ministry of Food, London, in favour of plantation grade conditional upon all copra accepted securing a minimum of 45 grading marks, and any copra which failed to secure the minimum marks to be reconditioned at the expense of the shipper and on being resubmitted for grading a fee of £1 per ton to be levied. This ruling came into force on January 14th, the system of grading used to be that which had been in use since 1942 and which on the whole had proved satisfactory to all concerned.

It was noted that the percentage of plantation copra accepted amounted to 13·5 per cent only, while of the 86·5 per cent of F.M.S., some 5·6 per cent of this was "smoked" copra, this class of copra being a comparatively new departure in copra production in this Colony. Further, some ·3 per cent of F.M.S. copra offered for grading had to be reconditioned under the penalty referred to above.

Copra buying was carried out on behalf of the Ministry of Food, London, by the local Copra Board, in co-operation with the local merchants who functioned as agents of the Board, and this system worked satisfactorily.

The closing price for copra for 1945 was £19 7s. 6d. for plantation and £17 17s. 6d. per ton for F.M.S. grade. These prices were adjusted first on January 14, 1946, to £19 7s. 6d. for plantation and £18 for F.M.S., subject to the condition that the minimum quality to be accepted must grade not less than 45 marks. The final adjustment of prices, including the price differential was made on January 28th when plantation grade was quoted at £18 5s. 6d. per ton and F.M.S. at £18 per ton.

Prices during the year showed the following increases:—

1946.	*Plantation.*	*F.M.S.*
January 14 ..	£19 7 6	£18 0 0
Jan. 28th ..	18 5 6	18 0 0
July 4th ..	23 10 6	23 5 0
Sept. 29th ..	26 9 0	26 3 6
Dec. 2nd ..	26 0 6	25 15 0

Weather conditions were favourable throughout the year and no hurricanes caused any damage to plantations.

Copra production by the main areas throughout the Group was as follows:—

	Tons.	
Vanua Levu	10,420 =	40·5 per cent.
Taveuni ..	5,908 =	23 ,,
Lau Group ..	4,383 =	17 ,,
Lomaiviti ..	2,580 =	10 ,,
Viti Levu ..	2,431 =	9·5 ,,
	25,722	
Add Rotuma ..	2,077	
	27,799	
B.S.I.P. and G. & E. Is.	840	
	28,639	

It is anticipated that subject to no damage to plantations through hurricanes, etc., production for next year, 1947, should be at least 30,000 tons, thereby approaching the record of 33,000 tons produced in 1932.

—H.R.S.

LOCAL CASH AND FOOD CROPS, 1946

In order to illustrate the extent and diversity of the crops grown in the Colony for home consumption, or for local sale, the following statement has been prepared. It is based on the available statistics collected in the course of field surveys during the year 1946 and on estimates made therefrom. The areas given are approximate only. Certain wild and uncultivated crops are partially used as a source of cash by Fijians. It is obviously not possible to consider any crops as grown solely for export, as they also contribute to local supplies:—

A.—CULTIVATED CROPS—(TOTAL ESTIMATED AREA APPROXIMATELY 350,000 ACRES).

Crops.	Area (A) Cultivated	Area (B) Cropped.	Remarks.
Cereals cut from grain—			
Millet	80	40	Grown as a supplementary food crop.
Maize	700	450	Principally a dry-zone cash crop.
Rice	26,773	26,773	Growers produced 17,000 tons rice.
Sorghum	20	20	Small areas—not common.
Pulses—			
Beans	320	300	Market garden and household crops.
Soya Bean	10	6	Rarely cultivated by Chinese and Indian growers.
Pigeon pea	2,800	2,200	Cultivated throughout dry areas.
Mung or Urd	300	300	Cultivated in dry areas; generally in short supply.
Others	400	400	Cowpea and other varieties grown for food.
Tuber and Root Crops—			
Potatoes	70	70	Average yield 3½ tons per annum. Total value £5,000.
Sweet Potatoes	600	400	Supplementary root crops throughout. No export.
Dalo	12,000	9,000	Staple food, grown principally in wet areas.
Tapioca	14,000	10,000	Staple food, grown throughout.
Arrowroot	30	30	*Tacca* and *Maranta* grown for starch.
Yams	3,000	2,800	Staple food, principally in dry zone.
Oilseed crops—			
Groundnuts	1,200	800	Mainly grown for export; some oil (1,500 gallons) expressed locally.
Sesame	40	40	Occasional in small areas (562 gallons expressed locally).
Spices and Condiments—			
Turmeric	30	20	Occasional in small areas; also wild in dry zone.
Carraway	12	12	Occasional in small areas.
Mustard	200	200	Grown throughout year, usually in small plots.
Ginger	80	60	Grown by Fijians and Chinese for local use and export.
Fibres—			
Tobacco	100	80	Casual crop on small holdings in dry zone.
Patwa	30	25	Small areas grown for home use for ropes.
Vegetables—			
Miscellaneous	470	400	Aggregate of small gardens and commercial areas.
Cabbages	80	80	Grown by Chinese and Fijians especially in Beqa Island.
Lettuce	120	120	Widely cultivated in small areas and market gardens.
Tomatoes	160	160	Widely cultivated in small areas and market gardens.
Tree and Bush Crops—			
Bananas	2,500	1,700	Cultivated throughout for food; main areas for export.
Lemons	4	4	Small groups of trees cultivated; wild trees abundant.
Oranges	80	80	Small groups of trees cultivated; wild trees common.
Grapefruit	30	30	Small groups of trees cultivated by Europeans, Chinese and Fijians.
Mandarins	120	120	do. do.
Other Citrus	20	20	do. do.
Pineapples	750	400	Commercial areas for canning and for export of fresh fruit.
Industrial Crops—			
Sugar cane	160,000	64,000	Grown under contract by Indians and a few Fijians.
Coconuts	120,000	100,000	Estates and native areas (Fijian production 60 per cent.) Total production 28,200 tons of copra.

B.—CROPS PARTIALLY EXPLOITED WITHOUT CULTIVATION— (ESTIMATED APPROXIMATE EQUIVALENT AREA 5,310 ACRES).

Crops.	Area (A) Cultivated	Area (B) Cropped.	Remarks.
Sisal..	3,000	3	Has spread widely in dry areas—fibre occasionally prepared by hand.
Castor Oil	600	Nil	Has spread widely in dry areas—oil expressed locally for home use.
Turmeric	200	5	Has spread widely in dry areas—sold in bazaars.
Coffee	120	20	Cultivated in small groups throughout for home use.
Tea	50	50	Cultivated in plantations.
Cacao	15	Nil	Abandoned plantings rarely used.
Kapok	25	25	Scattered trees planted by Indians and Fijians, fibre collected has good local sale.
Rubber	800	200	Old plantations partially exploited, 161,879 lb produced in 1946.
Candlenuts	1,000	400	Wild trees throughout Fijian areas—300 tons of nuts supplied for local use and export; 4,030 gallons oil expressed locally.

C.—PERMANENT MEADOW.

Crops.	Area (A) Cultivated	Area (B) Cropped.	Remarks.
	acres.	acres.	
Permanent meadow ..	125,000	....	Natural grass areas throughout—used for general cattle grazing.
Permanent pasture ..	27,000	....	Partially improved areas—used principally for dairying and beef production.
Fodder crops	300	....	Cultivated small plots of *Sorghum*, Elephant grass, etc.

—B.E.V.P.

THE CURING OF TOBACCO

The leaves should be taken off the plant when, after having attained their maximum size, they have commenced to take on a yellow mottled appearance. Stringing up I have done with a medium sack needle, sewing through the main rib about 1½ inches from the thick end. After each leaf has been sewn make an ordinary knot with the needle, so that each leaf is kept apart from its immediate neighbour. This also prevents them sagging together in the middle, as the ribs shrivel during the drying change. Ordinary cuphooks screwed into the rafters of the drying shed or porch make convenient holders for the string, and the knots throughout the string readily adapt themselves for stretching to meet the cup-hooks.

The leaves should be gathered on a sunny day after the dew has thoroughly dried off. Before stringing examine each leaf thoroughly for leaf miner, by holding up to the light, and destroy same if observed, by squeezing between finger and thumb. A glassed-in-porch makes an ideal place for drying close up to the rafters, allowing enough room for a current of air to pass between each row of leaves.

It usually takes from eight to ten weeks for the leaves to dry thoroughly, after which they may be taken down and pulled off the strings and laid out flat upon each other. This operation must not be done when the leaves, which are very susceptible to climatic conditions, are either too dry or too wet. A safe guide is when, if the leaves are

clenched in the hand, they feel dry but do not crack. They may now be packed away in boxes under light pressure until such time as the actual curing is done.

It is usually conceded that the longer the leaf is kept, up to five years, the better the flavour of the finished article, but quite a good tobacco can be made after the leaf has been three months off the plant and it is the result of experiments conducted with this class of leaf, which I am giving, as most growers are anxious to sample their own grown.

If one is satisfied with one's effort, make a mental note to plant next season sufficient for at least three year's supply, to be followed by an annual supply each succeeding year, so that matured leaf is assured for the future.

Always keep the strings or boxes labelled with date of harvesting, variety, etc.

The first operation in the actual curing is the removal of the midrib, either with a sharp knife or by pulling the leaf off one side at a time from the tip downwards. Lay these half leaves one on top of each other, about 12 to 16 leaves, and roll up tightly together from end to end, when they will take on the appearance of a big fat cigar.

You will now need a sharp bread or carving knife for cutting the roll, finely if for cigarettes, or coarser if for the pipe, in much the same manner as one would cut up lettuce for salad. After cutting place the rounds in the oven for about five minutes, when they may be rubbed up into shreds by expansion caused by warmth.

Now comes the question of dressing or dope. For pipe tobacco I have found the following to give probably the most satisfactory results. Equal parts each rum and glycerine to double the quantity of molasses or honey, or invert sugar with just sufficient boiling water added to make the whole mixture run freely when sprinkled on to the cut up leaves. Work in just sufficient of this dope so that when rolled up tightly in the hand like a tennis ball it will just seep through.

If an old copying press is available wrap up in a piece of greaseproof paper and place under pressure for a few minutes if a light tobacco is desired, or for some hours for a darker. After removing from the press place in the oven or frying-pan, when the heat will cause expansion and make the whole bulk easily teased out with the finger.

Replace in frying-pan or oven to " toast ", as the trade calls it, but in reality to drive off excess moisture and also the volatile vegetable flavour so common to most of the " home-brews."

For cigarette tobacco the same process may be employed, but instead of molasses use golden syrup or clear honey and as little moisture as possible to maintain a good bright colour.

The middle leaves on the plant are usually the full flavoured ones most suitable for pipe tobacco, whilst the lower leaves usually have a decided cigar flavour. The higher leaves are usually conceded the best for cigarettes.

Apart from packing away in airtight tins until required, this completes the operations in so far as my experiments and observations are concerned up to the present.

[A. DALE.—"The N.Z. Smallholder," 16th July, 1935.]

AGRICULTURAL SCHOLARSHIPS

During the year a very important advance was made when Government provided two scholarships for local youths to undertake a diploma course of training at Gatton Agricultural College, Queensland, with a view to their qualifying for appointment to the Fields Division of the Department.

In addition, a Fijian co-operative (the Fijian Co-operative Market Association Limited) generously offered to defray the expenses for one of the Department's Fijian staff to attend a similar course. Selections were made by the end of the year and the three students were accepted by the College for the course to commence in 1947.

REVIEW

PRACTICAL PEST CONTROL IN THE PACIFIC

Published late in 1946, *Bulletin* No. 23 (1) on the insect pests of Fiji is a noteworthy addition to the permanent records of the Department of Agriculture, Fiji, and one which will be welcomed by farmers and gardeners throughout the Pacific.

The author, Mr. R. J. A. W. Lever (lately Entomologist of the Department), who is well known to readers of this *Journal*, states in the introduction that his object is to give the planter, gardener or horticulturist some information about the insects which most commonly attack crops in the Colony and how to combat them.

He has drawn upon many years' experience in the Solomon Islands and the Fiji group to produce a most useful manual for every day use and one which will assist gardeners first to recognize their enemies and then to apply the proved treatment for their control.

The *Bulletin* is divided into five parts, the first of which deals with the classification, elementary anatomy and life histories of insects—knowledge which is necessary to enable the reader to recognize easily the species with which he is mostly concerned. In the second part, the chief insect pests of fruit trees, vegetable garden and allotment crops, native and estate crops, and the damage they cause, are dealt with, and methods of control explained. The pests of stored products and those commonly associated with households are also described.

In another section, beneficial insects and the biological control of pests and weeds are briefly discussed, and an important section summarizes valuable information on control measures. Reference is made to the more useful insecticides which have proved effective under local conditions and a spraying table is provided.

Much useful information is to be found in the six appendices. The first of these is a list of the chief insect pests and the crops attacked, and this provides a convenient cross index to the account of the crops given in the text. There are instructions for the collecting and packing of entomological specimens, a glossary of technical terms, some useful measures, and notes on first-aid for poisoning, this latter necessitated by the fact that many insecticides are strong poisons.

In appendix V, the garden pests which are not insects, viz., mites or red spiders, land crabs, slugs, millipedes and worms are dealt with and control practices explained.

Finally, the relation between weather conditions and insect infestations is discussed and meteorological data for Fiji are given.

The *Bulletin* is illustrated with a map of the Colony and with six plates figuring 34 important insect pests, and one plate giving details of insect structure. The very moderate price of one shilling brings within the reach of everyone a publication which should find a ready demand both within the Colony and from outside.

The attention of readers is drawn to the list of errata given below mainly in the references to Plate numbers. These are apparently due to the author being absent from the Colony when the Bulletin was printed.

B.E.V.P.

REFERENCES.

(1) "Insect Pests in Fiji" by R. J. A. W. Lever, B.Sc., D.I.C., A.I.C.T.A., F.L.S.—*Bull.* No. 23, Department of Agriculture, Fiji—Government Printer, Suva. Price 1*s.* (36 pp 7 plates and 1 map).

ERRATA

Bulletin No. 23, "Insect Pests in Fiji".

Pages 1, 3, 7, 9, 10, 11 and 12, for "Plate VI" read "Plate VII" and for "Plate VII" read "Plate VI".

Pages 2, 11 and 23, for "Part 4" read "Part 5".

Page 5, third paragraph, for "*Elrytrurus*" read "*Elytrurus*".

Page 7, second paragraph, for "*Euchrosops*" read "*Euchrysops*".

Page 13, fifth complete paragraph, for "*cyanophitti*" read "*cyanophylli*".

USE OF "GAMMEXANE" DUST AGAINST DOMESTIC COCKROACHES

Mogadishu, capital of Somalia (ex-Italian Somaliland), is seriously infested with three species of domestic cockroach, which Dr. B. P. Uvarov of the Anti-Locust Research Centre has kindly identified for me as *Periplaneta americana* (L.), *Blattela germanica* (L.) and *Supella supellectilium* Serv. Almost all houses contain a sufficient number to cause frequent damage to fabrics and tainting of food and cupboards. Constant cleaning or spraying with pyrethrum or DDT produced poor results, and it was decided to attempt control with "Gammexane" dust. I am indebted to Mr. D. E. Kevan of the Department of Agriculture, Kenya, for suggesting this method to me.

The "Gammexane" dust was as supplied for use in locust bait, and contained 10 per cent of "active ingredient". It was applied with a simple hand-duster which delivered a strong fine jet of dust. During the day-time the cockroaches sheltered mainly on the shaded undersides of horizontal surfaces, such as shelves in cupboards, and the dust was, therefore, only applied to such places and behind articles of furniture. The results far exceeded expectations. Immediately after dusting, the insects showed signs of distress, and most of them left their hiding-places and ran up the walls. Within an hour many were unable to stand, and after twelve hours all *P. americana* were dead or dying, except the largest specimens, and the latter were incapacitated and died later.

Several premises were treated with the same results; but the kill was poor if the dusting was done at night-time, presumably because the insects had left their hiding-places and were generally distributed.

The dust did not affect the eggs, but for a few days after treatment dead first instar nymphs were found; this indicates that there was some residual effect. The eggs of *B. germanica*, which are carried by the females in the oothecæ until they hatch, were swept up with the dead bodies, and could be destroyed by burning. It seems unlikely, however, that nymphs from such eggs would survive, as their first food would presumably be the "Gammexane" coated bodies of dead cockroaches. The eggs of the other two species remained behind in the oothecæ attached to the hiding places, and some of these ultimately produced nymphs that survived. It was, therefore, found advisable to dust again after an interval of three or four weeks.

Premises so treated remained reasonably free of cockroaches for about three months; but they were gradually re-invaded, and after three months it was again possible to find the insects in fair numbers.

It was found that 250 c.c. of dust was an adequate dose for one dusting of a house or flat containing a kitchen and four other rooms, and that this gave the required kill without leaving a noticeable deposit of dust.

During dusting, the operator suffered temporary discomfort from irritation of the nostrils and throat, but no after-effects were observed. Treatment produced an unpleasant smell that lasted for about two hours, but in cupboards, etc., the smell lingered for a few days. It was, however, generally considered to be far less unpleasant than the smell of the insects.

This note has been written in the hope that it may be of use to residents in cockroach-infested places, and because it is considered that the method is worthy of further investigation which I am unable now to undertake.

—H.B.N. HYNES.

(Extract from *Nature*, Vol. 159, No. 4032, February 9, 1947, p. 200.)

DESTRUCTION OF WILD PIGS

The following is a record of pigs destroyed by hunting parties organized by the Indian settlers at Vunikavikaloa, Ra, on the advice of the Department of Agriculture. The work, which has been assisted by the granting of 30 dog licence exemptions, has been under the general supervision of Mr. Jaikaran, Member of the local Advisory Committee.

His report is as follows:—

1945—Sept.–Dec. ..	255	pigs killed
1946—Sept.–Dec. ..	119	,,
1947—Jan.–March .	20	,,

The District Officer, Ba, has increased the number of licence exemptions to 40.

—C.M.D.